late-type stars and have been extensively discussed by K. M. Merrill (IAU Symposium No. 42, Bamberg, 1977).

The observations were carried out during the nights of 4 and 5 December, 1982. The reductions have been made using the stars B1 Ori (spectral type C6.2; $T_e = 2670°$ K) and TX Psc (spectral type C6.2; $T_e = 2650°$ K) as standards. Both stars are known to lack an envelope and to show no infrared feature in the spectral range observed. The results are shown in Figures 1 and 2. When no error bar is given, the internal accuracy is roughly equal to the size of the plotted points. In 1-min integration time, the signal-to-noise ratio achieved for R Lep (N = −2.5) was approximately 100.

The silicate emission band is seen in oxygen-rich stars. Fig. 1 shows the relative $\lambda\lambda$ 8 – 13-μm spectrophotometry of two representative M supergiants, α Ori and VX Sgr. The silicate emission band is clearly seen in α Ori and very strong in VX Sgr, which are well-known results.

The silicon carbide band is seen in carbon-rich stars. The fundamental constituent of the dust in the envelope of these stars is relatively featureless (Forrest et al., 1975, *Astrophysical Journal* **195,** 423) and is generally considered to be condensed carbon. That carbon is mixed with SiC, gaseous CO and other metallic molecules in an expanding envelope of which the principal indicator is then the emission due to the SiC.

Fig. 2 shows the relative $\lambda\lambda$ 8–13-μm spectrophotometry of a sample of carbon stars, together with the appropriate black-body slopes for each star. Some of the stars of the sample were already known to have an envelope (X Cnc, U Hya and the famous Mira variable R Lep). The detection of an envelope (X Cnc, U Hya and the famous Mira variable R Lep). The detection of an envelope around U Ant is new, however, as is the detection of a very dense one around TW Hor. This latter envelope deserves special mention regarding the controversy on its reality, as discussed by P. Bouchet et al. in the same issue of *The Messenger.*

Two other carbon stars, not known to bear an envelope, were also observed and were not included in Fig. 2: W CMa (spectral type R_8, variability type L_b), which did not show any silicon carbide emission, and AB Ant (spectral type N_o, variability type SR_b), which does seem to show such emission. However, the S/N in the latter case is too small to lead to a definite conclusion.

Conclusion

Envelopes have been detected around the carbon stars U Ant and TW Hor and, probably, AB Ant, while the spectrum of W CMa does not show any SiC signature. The existence of envelopes around X Cnc and U Hya has been confirmed, and our results for the M supergiants α Ori and VX Sgr and the carbon-Mira R Lep reproduced perfectly those obtained by Merrill (1977) and previous observers.

These results should give a good notion about the exciting new infrared facilities offered henceforth at the 1 m telescope on La Silla. It should also be emphasized that these observations were made during the first observational test of the equipment and, as such, the signal-to-noise ratio achieved in our measurements should further improve in a very near future, when the system becomes thoroughly operational. Special thanks should be given to the ESO staff in Garching who made the project a reality, namely A. F. M. Moorwood and A. van Dijsseldonk, and the technical staff at La Silla, especially J. Roucher and F. Gutiérrez, who assisted and helped me with their active efficiency during these first tests. I would like to thank also Miss Victoria Tapia who made the drawings.

Chemical Composition in the Small Magellanic Cloud

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The Magellanic Clouds are the two nearest galaxies; the well-known great Andromeda Nebula M31 is about ten times farther away than the clouds. They are much smaller than M31, but their nearness justifies the large amount of observations devoted to them, particularly at La Silla. They provide us the best suitable tests at least for two fields of theoretical astronomy.

The first one concerns models describing the evolution of the mean chemical compositon in a galaxy. The nuclear reactions which produce the energy radiated by stars lead to the synthesis of heavy elements (i.e. heavier than helium). Part of these heavy elements are then ejected in the interstellar medium by way of stellar winds or novae or supernovae explosions. Then the enriched interstellar matter is recycled to form a new generation of stars. This behaviour is modelled as a function of various parameters. The total mass of the galaxy, and the ratio of the mass of the interstellar gas to the mass condensed in stars are two major parameters in these models. The large and small clouds have different masses, 6×10^9 and 1×10^9 $M_\odot$ respectively, which is small compared to the mass of our galaxy (about 150×10^9 $M_\odot$).

The ratio mass of interstellar gas/mass of stars is also different (5 per cent in the LMC, and 30 per cent in the SMC). Therefore, models of chemical evolution of galaxies can be applied to two very different objects which are also very different from our galaxy. Obviously a crucial check for these models is to compare the predicted chemical composition with the observed one.

Before discussing how the chemical composition in the clouds can be determined, let us briefly mention the second main interest of the clouds: the kinematical interaction between galaxies. The clouds are gravitationally linked to the Galaxy. Tidal effects due to the large mass of the galaxy are expected to be a major factor in the dynamical and kinematical evolution of the clouds, at least when the "first close encounter" between the clouds and our galaxy occurred, presumably, 1 to 3×10^8 years ago. Observational tests in this field are the determination of the three-dimension morphology of the clouds, which is still much debated, and the study of the velocity field distribution, from radial velocity measurements.

(A) From Which Objects Can We Determine the Chemical Composition?

Traditionally, chemical compositions are determined from high-dispersion stellar spectra, but another interesting way is the spectroscopy of bright gaseous nebulae: H II regions, planetary nebulae or supernova remnants.

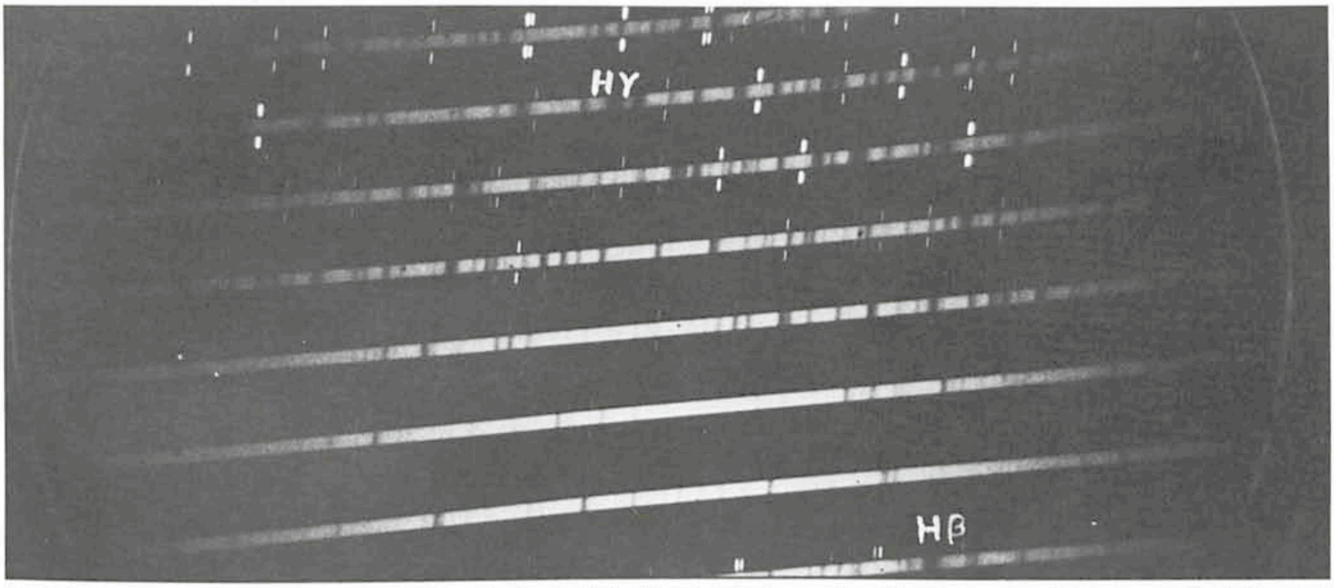

Fig. 1: *Spectrogram of the SMC supergiant AZ369, obtained with the Echelec spectrograph and the electronographic camera at the 1.52 m ESO telescope. The reciprocal dispersion on the original is about 9Å/mm, depending on the order. The exposure time was 8 hours 21 minutes, with a seeing of 2″ (entrance slit: 1.3″) and a good transparency.*

1. The Stars

Observations of stars in the SMC are quite delicate:

– They are remote objects, more than 200,000 light years distant. Stars of which the chemical composition is usually determined lie in the solar neighbourhood, at a distance from the sun 100 times smaller.

– The brightest stars in the SMC are intrinsically fainter than in the LMC (at a distance from the sun smaller by about 15 per cent) roughly by one magnitude.

– The surface density of stars in the direction of the clouds is very high, implying a risk of contamination of the observed spectra. The brigthest stars, i.e. the easiest to observe, are supergiants. This adds another difficulty to the interpretation of their spectrum in terms of atmospheric physical parameters. This difficulty is illustrated as follows: The brightest star in the SMC HD 7583, with a magnitude $M_v = 10.1$, has been studied by Przybylski and also, at La Silla, by Wolf. The first found that metals in this star are ten times less abundant than in the sun, whereas the second found that its chemical composition is not significantly different from the solar one; but Dubois,using low-dispersion spectrograms obtained with the 1.52 m ESO telescope, has shown that spectral lines of this exceptionally bright supergiant are variable.

Using the same telescope, with the Echelec spectrograph and the Lallemand-Duchesne electronographic camera, I have observed four stars expected to be "normal" cool supergiants in the SMC on the basis of photometric and low dispersion spectrographic data. I have chosen supergiants not extremely bright and relatively cool (with roughly solar temperature) to have less severe problems in the interpretation of the spectra. Magnitudes range from 11.1 to 13.3 in the visible: Add about 0.6 to 0.7 magnitude to obtain the magnitudes in the blue, the spectral range in which the observations were carried out.

High dispersion spectroscopy of such faint stars at the coudé focus of a moderate size telescope is quite difficult. Identification of stars in the small but crowded field of the coudé focus is sometimes not simple. Exposures were very long, up to more than 9 hours, and had to be done in complete darkness, because of the high sensitivity of the detector. How many times the night assistant and I must have shouted to visitors in the coudé room: "No luz, no luz . . ." (and ". . . por favor" at the beginning of the night)? Guiding also was hard.

I obtained good quality high-dispersion spectrograms (see Fig. 1). This was possible thanks to the staff of the electronographic camera at La Silla (J. Breysacher at the beginning, then P. Giordano and A. Torreron) who prepared the cameras with great care. It is a pleasure for me to thank them here again.

I performed the analysis of the spectrograms at Meudon. One star turned out to be a galactic giant on the line of sight of the SMC; the three others are really SMC members. One of them is completely analysed (Foy, R. 1981 *Astronomy and Astrophysics* **103,** 135): It is AZ369. Except for HD 7583, it is the only star which has been analysed in detail in the SMC. I found that metals are moderately deficient with respect to the solar abundances: There are 2.5 times less metals in this star than in the sun. From the present state of the analysis of the two remaining stars, I think that the metal abundances which I shall derive very soon will not be significantly different. This moderate deficiency of metals in stars is confirmed by low-dispersion spectroscopy of F supergiants and of RR Lyrae type variables.

2. The Bright Gaseous Nebulae

Interstellar matter is bright around stars able to excite the gas, or on the front of shock-waves. In H II regions, the gas is excited by one or several very young hot stars. Due to the large volume concerned, the total luminosity of an H II region is high, so that it is possible to observe this kind of objects in remote galaxies. A lot of work on emission lines in H II regions in the SMC was done with the 4 meter Anglo-Australian telescope by Pagel and collaborators. They found that oxygen is deficient by almost a factor of 10, and nitrogen by a factor of 40 with respect to the sun. This extra deficiency of nitrogen is well accounted for by models of chemical evolution of a galaxy. Nitrogen would be a second-generation element, extremely deficient, if existing, in the matter of the proto-galaxy from which the SMC was born.

Similar results are obtained from the analyses of planetary nebulae spectra, the circumstellar components of the remnant of a nova explosion.

The unique supernova remnant analysed in the SMC also reveals a marked deficiency in nitrogen with respect to oxygen, but no firm value is proposed for the oxygen abundance.

(B) What is the Chemical Composition in the SMC?

The discrepancy between the abundance determinations either from detailed analysis of stellar atmospheres or from studies of emission spectral lines in nebulae would not be as large as it seems. Indeed, in the first case, abundances of elements such as titanium, chromium, iron, calcium are determined, whereas the emission spectrum of nebulae leads to the determination of the abundance of helium, oxygen, nitrogen, sulfur, argon, and sometimes chlorine. These last elements could be slightly underabundant with respect to the iron peak elements. What does it mean, if it is significant, and if the abundance of iron in AZ369 is representative of the iron abundance in the recently synthesized material in the whole SMC? Light elements, like oxygen, are mainly synthesized in massive stars, and iron peak elements originate from type 1 supernovae, of which progenitors are less massive stars. Therefore the ratio of the number of massive stars to the number of intermediate mass stars would be smaller in the SMC than in the solar neighbourhood. The initial mass function would be steeper in the SMC than in our galaxy.

Thus, what to do to achieve further progress?

Try to derive the oxygen abundance in stars, which is difficult, or to observe fainter stars, so that problems in the interpretation of the spectrum are much less severe. We hope to do that with the new CASPEC spectrograph at the 3.6 m telescope at La Silla.

MIDAS — ESO's New Image Processing System

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Introduction

In 1979 ESO began the planning and development of a new image processing system to fulfill the data analysis and image processing needs for the 1980's. It was decided to use a powerful 32-bit super-mini computer with virtual memory management as the basis for this development. The VAX 11/780 computer of Digital Equipment was chosen mainly because of its user-friendly operating system, VMS, and because the VAX had been selected by several other astronomical institutes. Indeed, the STARLINK system in the U.K. and the FIPS system developed at ESTEC for the Faint Object Camera are based on VAXes.

Soon after ESO's move to Munich, the first VAX 11/780 was installed and the actual development began. The software system was given the name "MIDAS" which stands for **M**unich **I**mage **D**ata **A**nalysis **S**ystem. In mid-1981, the image display systems were delivered, and in late 1981, the second VAX was installed. The developments progressed to the state where local users began using the MIDAS system in early 1982 and they have reached the state where outside users are being encouraged to use the system for analysing CCD data; however, at the present time the reduction package is not totally completed. Of course, the range of applications of MIDAS is growing rapidly beyond the CCD.

In addition to developing MIDAS for use at ESO in Munich, some effort has been put into making the system easy to transport to other VAXes with different graphics and image peripherals. A copy of MIDAS will be installed on La Silla soon after the VAX arrives.

Hardware Elements

The hardware configuration of MIDAS in Munich is shown in Fig. 1. The important components are the VAX CPUs with their associated disk and tape subsystems, the image display systems, and the Dicomed image recorder.

The heart of the system is the two VAX 11/780 computers linked together via DECnet. VAX-A is equipped with 3.5 Mbytes of memory, 1.2 Gbytes of disk storage and 2 tape drives with 800/1600 bpi density. VAX-B has 4.0 Mbytes of memory, 688 Mbytes of disk storage and one tape drive with 1600/6250 bpi density.

The philosophy behind the disk and tape arrangements was to enable users to keep an important quantity of their data on disk while they are actively reducing it and only to use tapes at the beginning and end of their work.

The image display systems used for MIDAS in Munich are 3 Gould-DeAnza IP-8500 systems. Each system is equipped with a powerful Digital Video Processor (i. e. an array processor processing entire frames of 512*512 pixels at video rates), and supports two user stations with each station having its own cursor and overlay. Currently each station has 4 image channels and 1 overlay channel of 512*512*8 bits each, as well as an alpha-numerics memory of 20*80 characters. Two of the IP-8500 systems are connected to VAX-A and one to VAX-B.

The DeAnza system of VAX-B includes also a video digitizer system connected to a TV camera. This system allows pictorial and graphical data to be entered quickly into the computer for making overlay and so forth.

The Dicomed image recorder serves as a high resolution hardcopy device for publication and reference. The output is normally on regular roll film and is of excellent quality. Fig. 2 shows an example of some output from the Dicomed.

In addition, a Versatec plotter is connected to each VAX. An HP plotter is also available on VAX-A.

The MIDAS work station is very similar to the one of IHAP. Each of the six MIDAS work stations consists of a DeAnza display, a VT100 terminal for command input and data in/output, and an HP 2648 terminal for graphic output. However, MIDAS procedures which do not require the interactive peripherals can be run from any terminal connected to the VAX. Output to the Versatec, HP Plotter and Dicomed is spooled like output to the printer.

The MIDAS Software Environment

The design of MIDAS was influenced by the following factors:

- The system should be compatible with the other major astronomical image processing systems which are currently developed, i. e. Starlink of Rutherford Appleton Laboratories in England, the Faint-Object-Camera Image Processing System of ESTEC in Holland and the system for the Space Telescope Institute in Baltimore.